

11. THE DIET OF THE INDIAN BULL FROG *RANA TIGERINA* (DAUD.)

The frog has been one of the most extensively studied laboratory animals. Yet sufficient attention has not been paid to its dietary habits particularly in the different seasons of the year, even though many species of frogs have been examined to ascertain their diet. Noble (1918, 1924) examined the stomach contents of several species of tree frogs and also of *Bufo bufo vulgaris* and *Rana temporaria*. The stomach contents of *Rana ridibunda* were examined by Smith (1953). Many others such as Needham (1905), Drake (1914), Liu & Chen (1932) examined the stomach contents of *Rana catesbiana*, *Rana pipiens*, *Rana limnocharis*, and *Rana nigromaculata* respectively. Studies have also been made on the diet and the feeding habits of the edible frogs, *Rana esculenta* (Linnaeus) and *Rana pretiosa*, by Tyler (1958) and Turner (1959). The latter author has studied the seasonal variation in the diet of the western spotted-frog.

From the observations of different authors the following could be listed as the food items of frogs: larvae of various invertebrates, molluscs, insects, young batrachians, the eggs and young ones of fishes. Tyler (1958) has recovered several species of various orders of insects and has concluded that *Rana esculenta* as a species is not selective in its food habits.

The frog *Rana tigerina*, popularly known as the Indian Bull Frog on account of its large size and loud call, is widely distributed in eastern Asia. The published records on the diet of this species refer to the unusual rather than the normal food of the animal. The present study was undertaken with the object of determining the ordinary diet of the species by the examination of the stomach contents during the different months of the year.

MATERIAL AND METHODS

The frogs were collected from a small pond, mainly rain-fed, with a surface area of approximately 150 sq. ft., on the outskirts of Baroda city. The depth of the water was about 20 ft. during the rains and between 5 to 10 ft. in summer. Water weeds were plentiful and the pond fauna consisted of aquatic insects, insect larvae, small crustaceans, and snails. The average maximum/minimum temperatures during the summer (March-June), monsoon (July-October), and winter (November-February) of the year under study were

39.8/22.8, 32.4/24.4, and 31.6/13.9 in degrees centigrade, and the total rainfall 75.2, 1359.6, and 8.4 mm. respectively.

OBSERVATIONS

The frogs were captured at night when out on land to feed. They were immediately killed and the stomach contents of each were separately preserved in 5% formalin. A report on the stomach contents is presented on pp. 265-7.

DISCUSSION

Frogs are known to prefer live moving animals chiefly insects, motionless creatures often being ignored. From the observations recorded in the present study it can be noticed that there is no special selection of food: Dermaptera (Earwigs) were found in the stomachs throughout the year, but the number was greater during the months of November and February. Thus it is seen that Dermaptera formed the chief item of diet in winter when these insects are found in large numbers, while Diptera were found to be the major item during late winter and early summer.

Coleoptera were found throughout the year except in January and February. Hemiptera reached their highest mark in the month of December. They were also found in good number during the last three months of the year. Hymenoptera were taken in only when they were available in large numbers. The number of ants was high in the months of April and May. The same was the case with Isoptera.

Lepidoptera, Arachnida, and Isopoda were also occasionally found. Myriopoda were found only after the first rain, while Orthoptera were obtained throughout the year except during the months of January and February. Young frogs during the breeding period fall a prey to the adult ones. At times bigger animals like mice, birds, and geckos become the victims of the adult frogs.

During the winter the feeding was comparatively less but in the rainy season the feeding reached its highest mark as during this period the adult frogs have just finished breeding and their reserve food is all depleted. In this season the insects are also plentiful. It was also observed that frogs captured on full-moon nights contained considerably more food in their stomachs. This was apparently due to their greater ability to find food in the moonlight.

Number collected/Number of stomachs from which collected

Months	January	February	March	April	May	June	July	August	September	October	November	December	Remarks
No. of stomachs examined	10	11	15	16	9	24	21	11	15	13	18	24	..
<i>Contents</i>													
MOLLUSCA Snail (<i>Limnaea gularia</i>)	^a 1/1	1/1	..	..	^a Shell
ANNELIDA Earthworms (<i>Pheretima</i> sp.)	4/1	..	1/1	2/1	..	2/1	..
ARTHROPODA Class DIPLOPODA Millipedes	27/19	2/1	3/2	..	..	..	..
Class CHILOPODA Centipedes	1/1	..
THYSANURA <i>Lepisma</i> sp.	1/1	1/1 3/1	..	..	..	..	..	..	..
Class INSECTA DICTYOPTERA Cockroach (Blattidae)	1/1	..	..	..	1/1	^b 1/1	..	..	..	2/1	^b With a ootheca
ISOPTERA (Termites)	^c Several/5	^c 50+/6	1/1	..	..	..	..	..	^c Winged forms
ORTHOPTERA Mole Cricket (<i>Gryllotalpa</i> sp.)	7/5	1/1	2/1	25/11	10/4	..	2/2	23/10	4/4	3/1	..

Months	January	February	March	April	May	June	July	August	September	October	November	December	Remarks
No. of stomachs examined	10	11	15	16	9	24	21	11	15	13	18	24	..
<i>Contents</i>													
DERMAPTERA (Earwigs)	13/5	20/11	1/1	2/1	1/1	6/4	2/1	2/2	7/3	10/4	12/6	7/3	..
HEMIPTERA (Bugs)	..	1/1	..	..	..	..	1/1	..	4/1	2/2	..	..	..
Geranium Bug (<i>Cydnius indicus</i>)	..	..	1/1	..	1/1	..	..	..	..	..	17/5	137/17	..
COLEOPTERA Families : Cicindelidae, Scarabidae, Curculionidae, Tenebrionidae	..	2/1	7/5	4/4	14/6	20/8	36/18	14/7	15/7	18/6	11/5	12/6	..
LEPIDOPTERA Moths (Rhaphalocera)	..	6/4	..	..	..	4/2	2/1	^d 8/4	^d 9/5	^d 4/2	1/1	..	^d Larvae
DIPTERA <i>Eristalis</i> sp. (larvae)	21/8	27/9	30/12	22/9	1/1	1/1	..	..	..	3/3	6/6	..	..
Housefly (<i>Musca</i>)	..	..	..	..	..	..	2/1	4/2	2/2	..	..	..	..
Other Diptera larvae	..	..	..	..	..	..	..	..	^e 4/2	..	..	215/6	^e Mosquito larvae

Months	January	February	March	April	May	June	July	August	September	October	November	December	Remarks
No. of stomachs examined	10	11	15	16	9	24	21	11	15	13	18	24	..
<i>Contents</i>													
HYMENOPTERA Formicidae (Ants)	..	2/2	..	18/3	35/7	30/9	7/3	18/8	5/1	..	4/3	12/4	..
Class ARACHNIDA Spiders (Aranae)	..	1/1	..	1/1	..	2/1	..	3/3	4/2	..	..	10/3	..
VERTEBRATA Class AMPHIBIA Juvenile Bull Frog (<i>Rana tigrina</i>)	..	..	..	..	..	..	1/1	4/2	2/2	1/1	..	..	..
Class REPTILIA Gecko (<i>Hemidactylus</i> sp.)	..	..	..	..	..	1/1	..	..	1/1	..	..	..	..
Class AVES	..	..	..	f ₁ /1	..	..	..	..	..	..	..	g ₁ /1	..
Class MAMMALIA <i>Mus</i> sp.	..	..	..	..	b ₁ /1	..	..	..	..	1/1	..	..	..
VEGETABLE MATTER	..	PG/1	..	..	..	..	..	..	LO/2	..	..	..	PG = Paddy grains LO = Leaves of onion

The type and number of the prey caught depends more on the availability of these animals during certain seasons rather than any particular preference.

DEPARTMENT OF ZOOLOGY,
M.S. UNIVERSITY,
BARODA,
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U. L. WADEKAR

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12. FURTHER STUDIES ON INDIAN SPIDERS OF THE GENUS *CYRTARACHNE* (FAMILY ARGIOPIDAE)

(With four text-figures)

INTRODUCTION

The Oriental spiders of the genus *Cyrtarachne* were first described by Thorell (1895). Pocock (1900) recorded two known and one new species. Tikader (1960) revised the Indian spiders of this genus and recorded two known and three new species.

Recently, I have received from my friend Dr. F. Schmid, some interesting spiders of the genus *Cyrtarachne* collected by the Swiss/Indian Zoological Expedition 1960-61. He made this collection from Assam and NEFA. during his Trichoptera collection tour. I have also made some collection of spiders of this genus from Maharashtra and Mysore States.